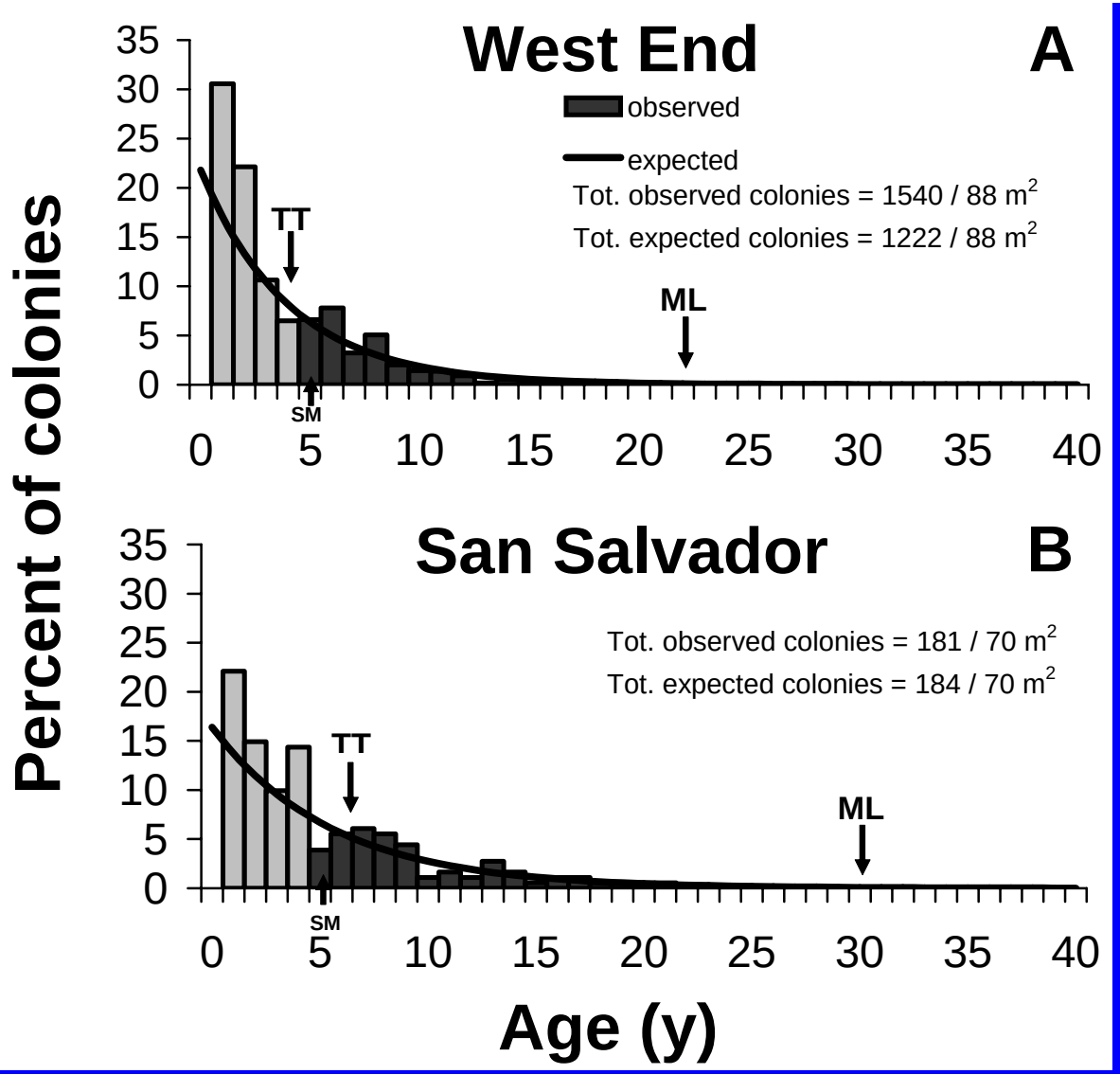
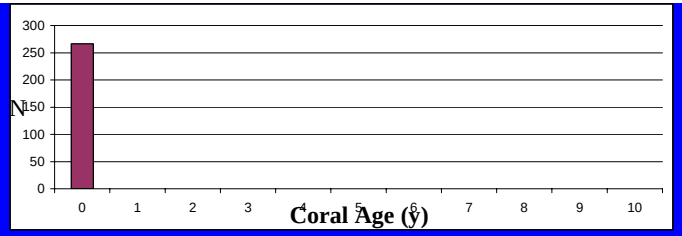


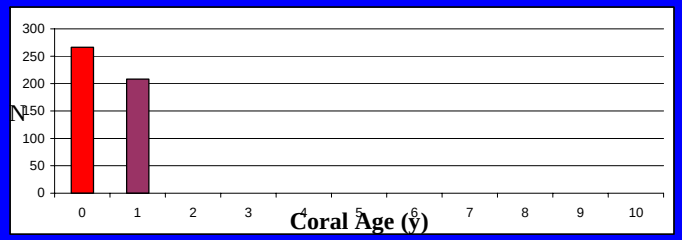
Population age structure and survivorship of natural populations

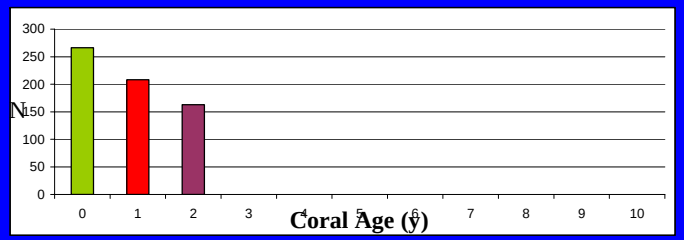
The populations have stable age structures

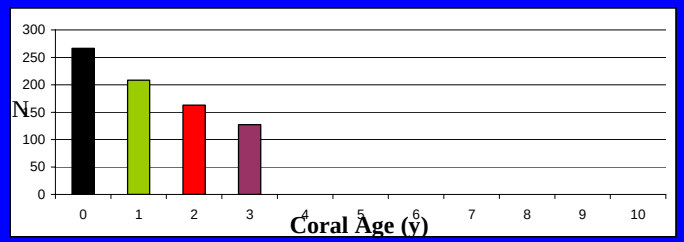
Pseudopterogorgia elisabethae. Age class distribution of populations, at West End, Grand Bahama Island 2007, and San Salvador Island 1999. Neither population has been commercially harvested. Line represents expected abundances for a population with a stationary age distribution

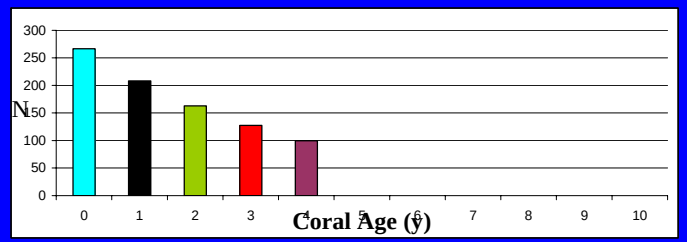
STEADY STATE POPULATION:
balanced recruitment and mortality

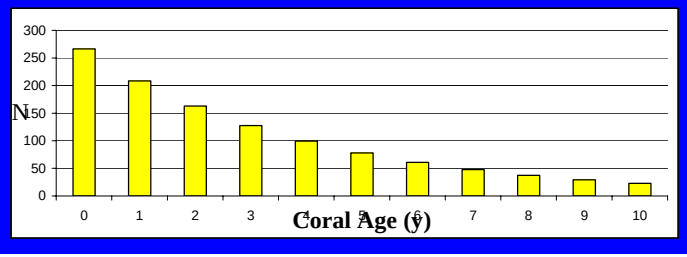






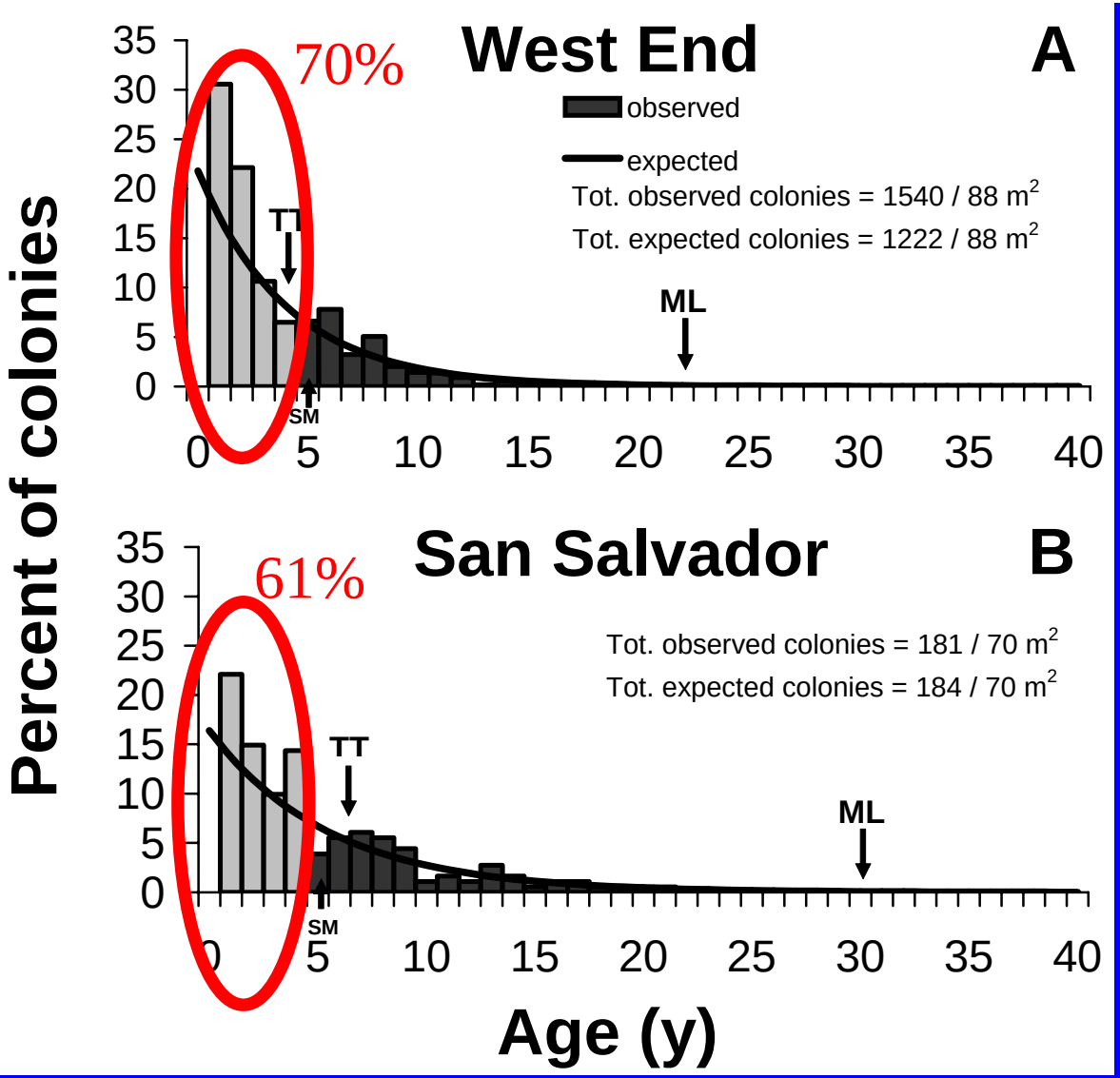






TIME (y)

Population age structure and survivorship of natural populations



The populations have stable age structures

Pseudopterogorgia elisabethae. Age class distribution of populations, at West End, Grand Bahama Island 2007, and San Salvador Island 1999. Neither population has been commercially harvested. Line represents expected abundances for a population with a stationary age distribution

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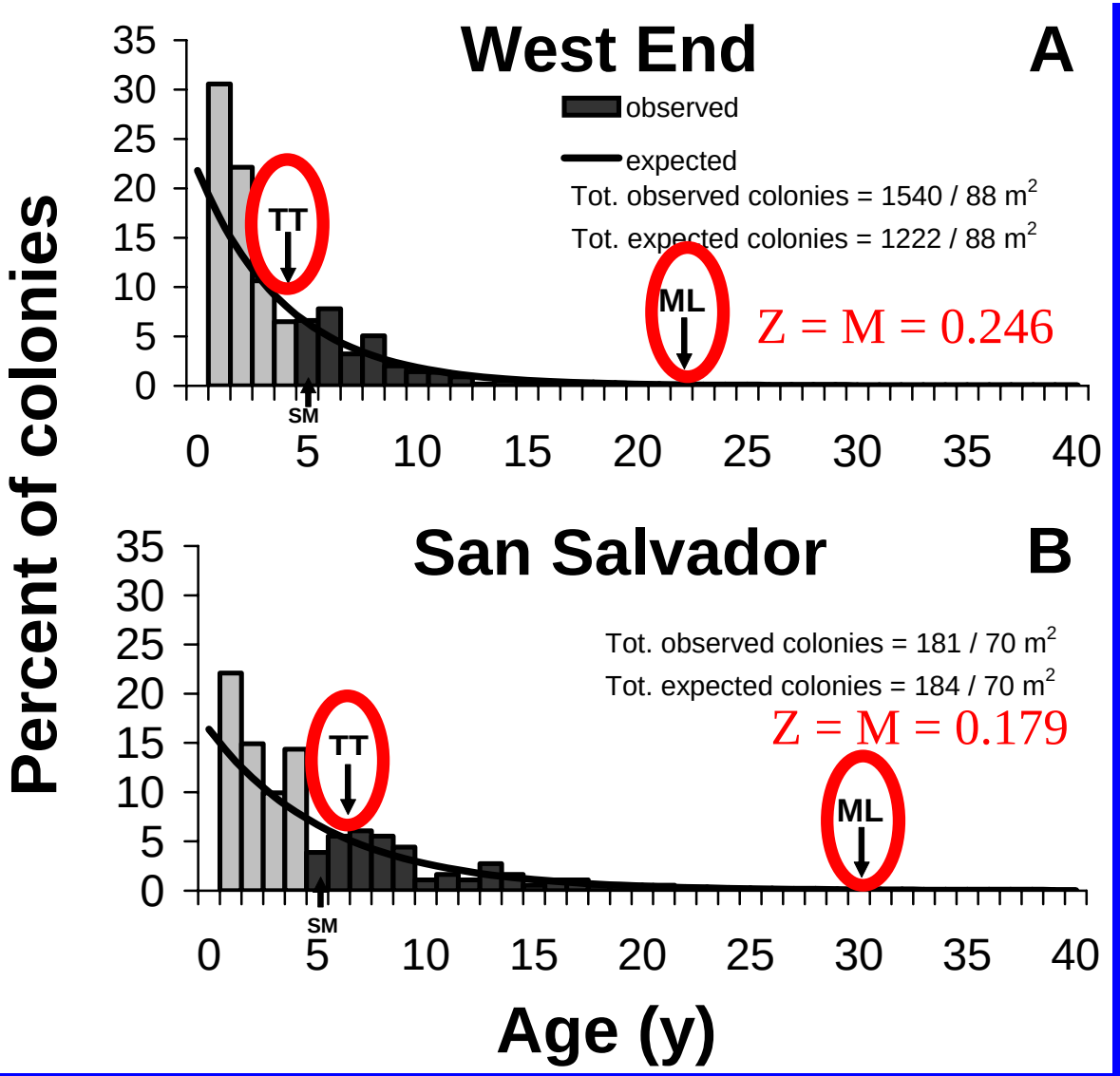

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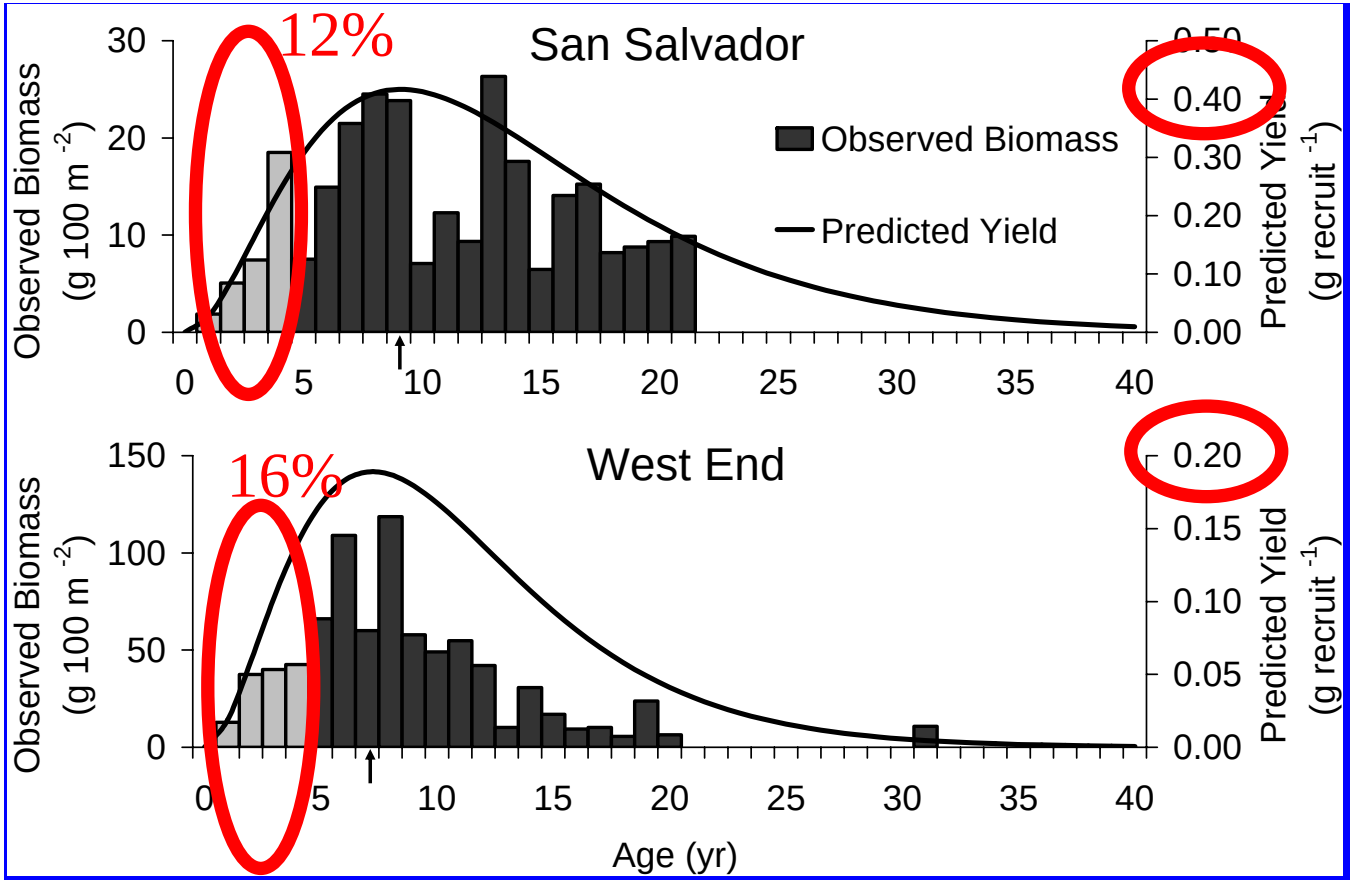


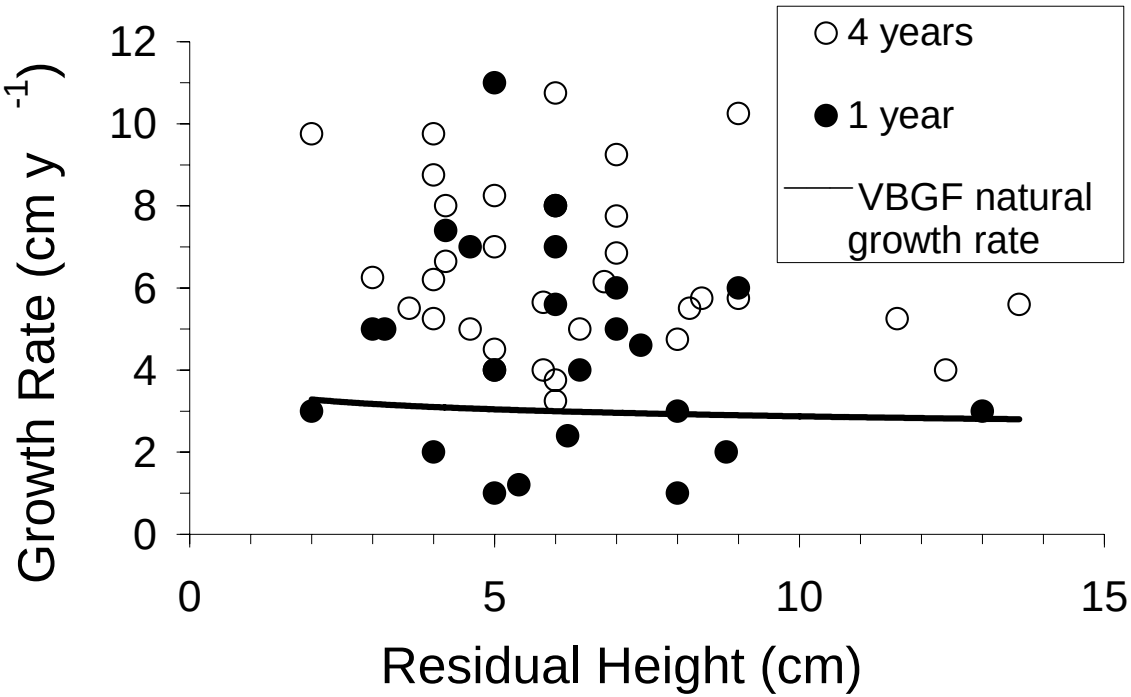
Pseudopterogorgia elisabethae. Age class distribution of colonies' dry biomass, and Beverton-Holt population yield curve in unfished populations at West End, Grand Bahama Island (2006), and San Salvador Island (1999). Observed biomass bars shaded gray are for colonies that have not reached reproductive size. Arrow denotes age at which the harvest will yield the maximum yield

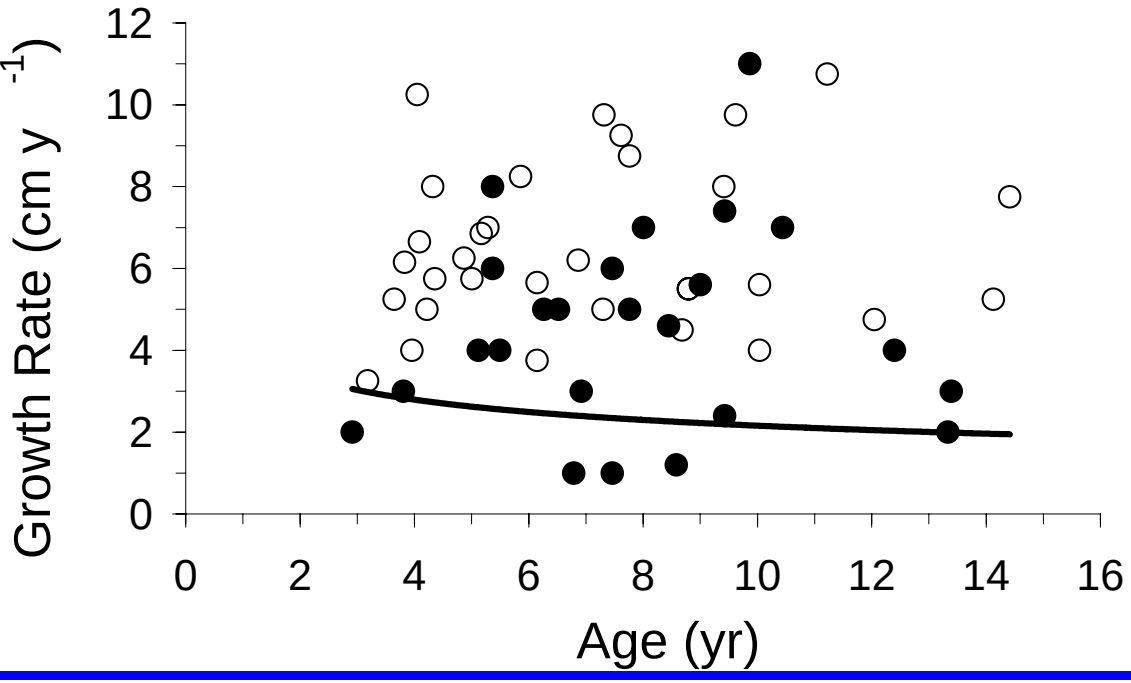
The age at maximum yield occurred 2-4 years after the age at sexual maturity

Parameters of the Beverton and Holt fishery management model, calculated for two natural populations of *Pseudopterogorgia elisabethae* in the Bahamas. *M* is the instantaneous rate of natural mortality (year-based analysis); MYR is the maximum yield per recruit; MSY is the maximum sustainable yield; MSL is the minimum size limit; $MSY_{(colonies)}$ is the number of colonies at or above the minimum size limit that can be removed per year per hectare.

Natural population	Standing crop: # colonies $hectare^{-1}$	Standing crop: kg of dry mass $hectare^{-1}$	*M*	Recruitment: # recruits yr^{-1} $hectare^{-1}$	MYR: g $recruit^{-1}$	MSY: kg of dry mass yr^{-1} $hectare^{-1}$	MSL: colony age (yr)	MSL: colony height (cm)	$MSY_{(colonies)}$: # colonies yr^{-1} $hectare^{-1}$
West End	175,000	81.5	0.246	43,000	0.19	8.1	7	21	4414
San Salvador	26,000	27.0	0.179	4,600	0.42	1.9	9	28	523

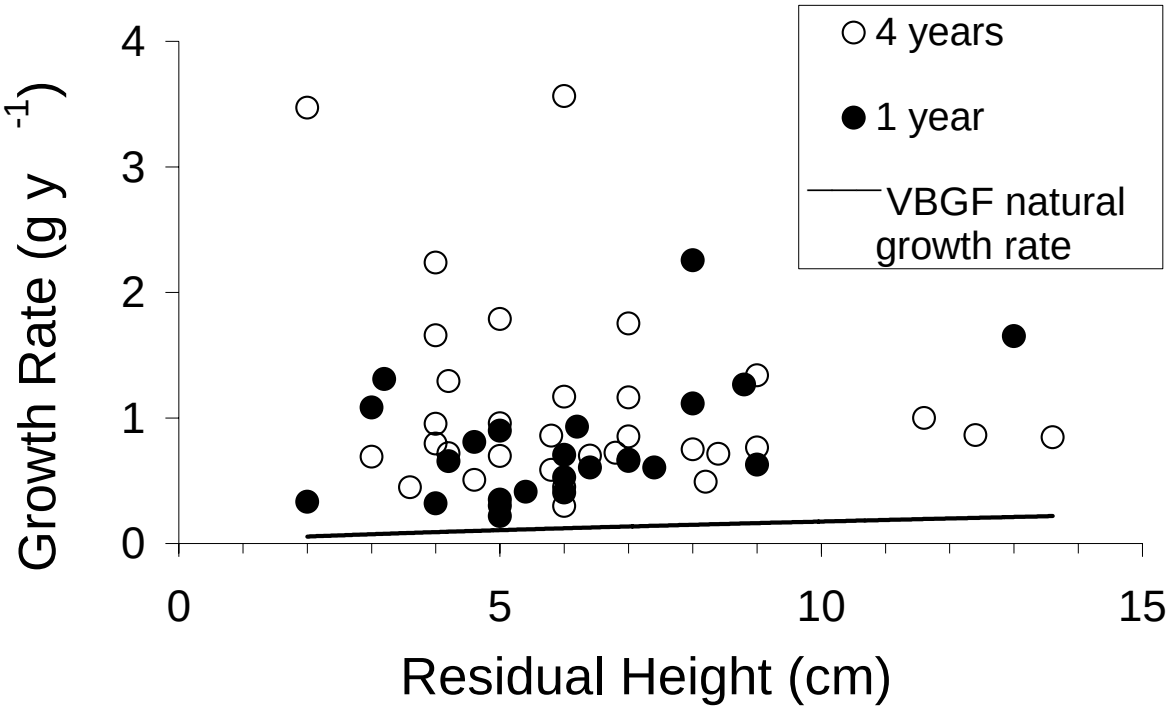
Regrowth of colonies after harvesting

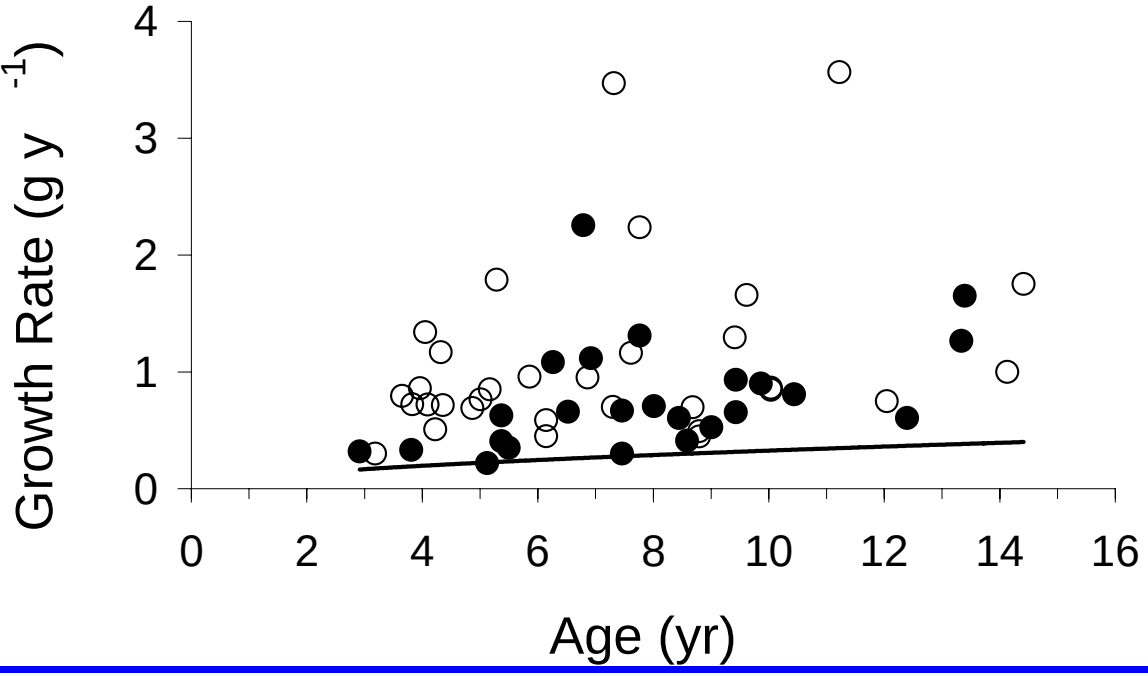




Pseudopterogorgia elisabethae. Linear growth rates of clipped colonies 1 and 4 years after clipping are compared with natural growth rates expected for unclipped colonies of same age or size. VBGF, is the Von Bertalanffy growth function obtained from microscopic analysis of growth rings, described in Goffredo and Lasker (2006)

Regrowth of colonies after harvesting





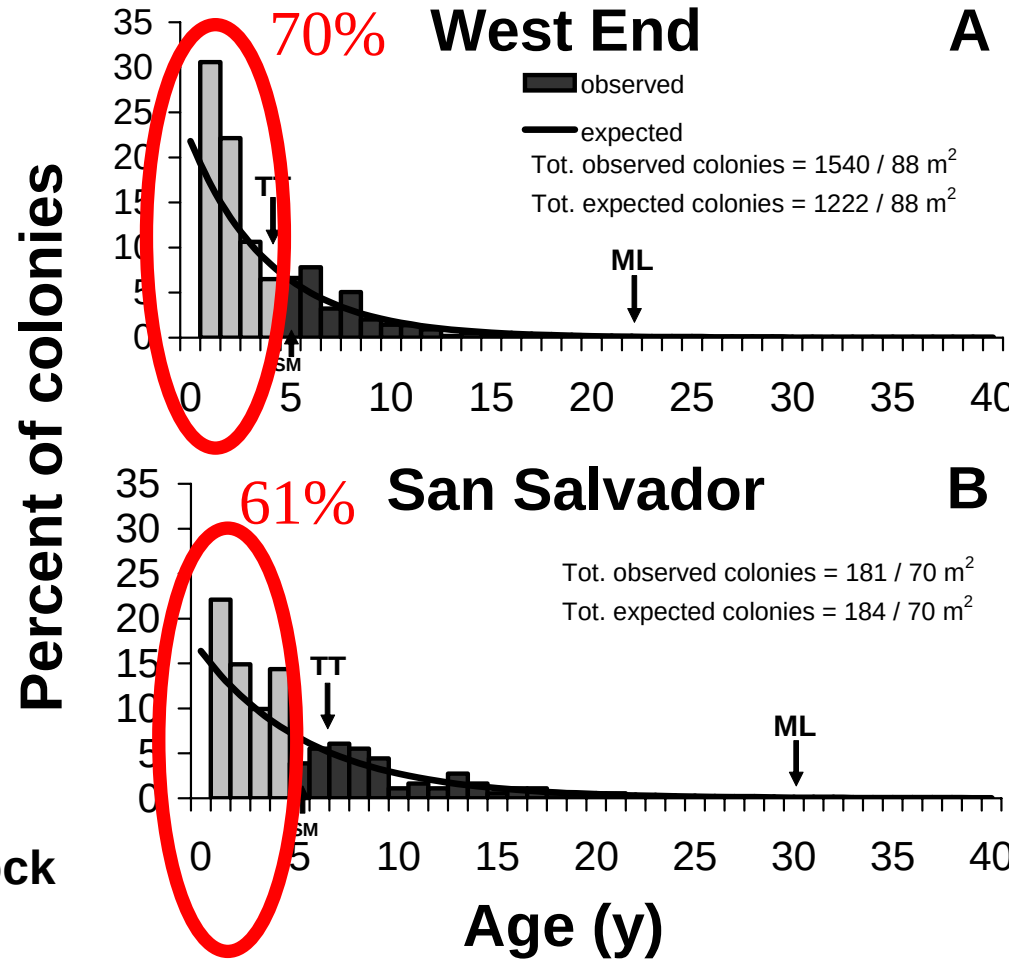
Pseudopterogorgia elisabethae. Dry mass growth rates of clipped colonies 1 and 4 years after clipping are compared with natural growth rates expected for unclipped colonies of same age or size. VBGF is the Von Bertalanffy growth function obtained from microscopic analysis of growth rings, described in Goffredo and Lasker (2006)

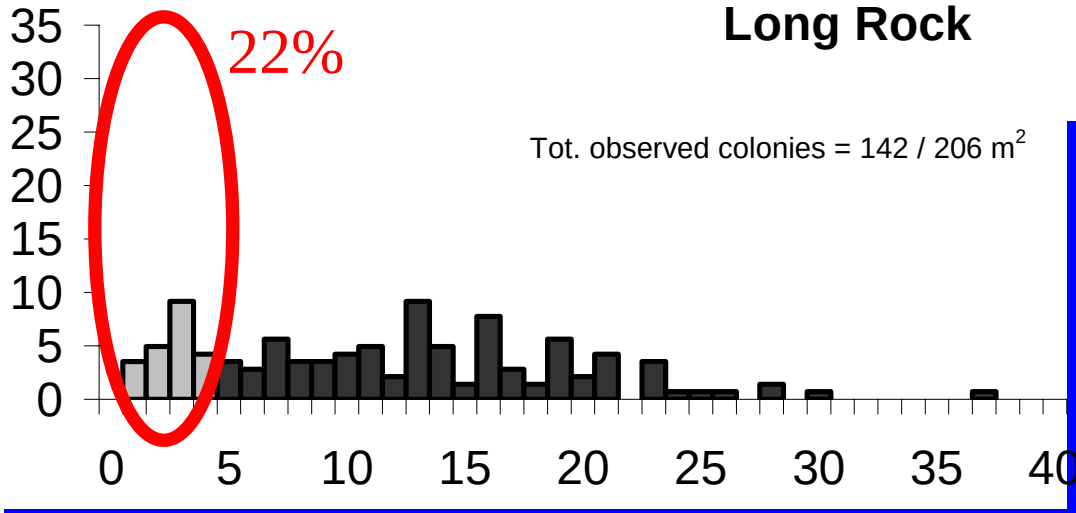
Pseudopterogorgia elisabethae colony that was initially harvested 12 Sept 1997 and was then collected in March 1999. Lines near base indicate points at which the colony branches were cut in the original harvest. Grid lines are 10 cm apart

NATURAL POPULATIONS

Population structure

HARVESTED POPULATION





CONCLUSIONS

- compensatory growth is clearly a key component in maintaining the populations of *P. elisabethae* at the harvested sites

- the Beverton-Holt model provides a conservative estimate of the yield that the fishery can generate

-reduced recruitment at the harvested sites may be a consequence of reduced fecundity and settlement caused by the harvest

- The Beverton-Holt model can be developed from data that can be collected in a single field season and thus can provide a starting point for an adaptive management approach for a new fishery